

NOTES ON THE GENUS *SCIRPUS* SENSU LATO IN
MISSOURI

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ABSTRACT. The taxonomy of the Missouri members of the genus *Scirpus* sensu lato is discussed in light of recent classifications, and justifications are presented for segregating the 26 species into 5 genera: *Scirpus* sensu stricto, *Schoenoplectus*, *Bolboschoenus*, *Isolepis*, and *Trichophorum*. Nomenclature of the Missouri taxa is summarized. Three species (*Isolepis molesta*, *Schoenoplectus mucronatus*, and *Schoenoplectus purshianus*) and two putative hybrids (*Schoenoplectus acutus* × *tabernaemontani* and *Schoenoplectus acutus* × *heterochaetus*) are discussed as additions to the state's flora, and the status of three other recent additions (*Schoenoplectus deltarum*, *Schoenoplectus saximontanus*, and *Scirpus pedicellatus*) is updated.

Key Words: *Bolboschoenus*, Cyperaceae, *Isolepis*, Missouri botany, *Schoenoplectus*, *Scirpus*, taxonomy, *Trichophorum*

The genus *Scirpus* L. sensu lato occurs nearly worldwide and commonly is called "bulrush" in North America. As traditionally treated, it contains some 200–300 species (Tucker 1987). Of these, 48 were included in the last comprehensive treatment for North America (Beetle 1947), which is now outdated. Steyermark (1963) treated 19 species in Missouri. Because of subsequent range extension discoveries (see below) and the publication of several taxonomic studies, notably a revision of *Scirpus* sensu stricto (Schuyler 1963), the next summary of the state's flora (Yatskievych and Turner 1990) included 23 species. Other discoveries since, discussed below, have increased the number of bulrushes known to grow in Missouri to 26 species.

Most North American authors have accepted *Scirpus* in the broad sense, with a variety of species groups sometimes recognized as sections. Worldwide, it is the largest genus in the tribe Scirpeae and the third largest in the family Cyperaceae (Tucker 1987). The classification of species groups within *Scirpus* sensu

lato has remained controversial (cf. Tucker 1987). In contrast, in recent decades many authors outside of North America have divided *Scirpus* sensu lato into various segregate genera (e.g., Wilson 1981; Goetghebeur and Simpson 1991). They have accepted a narrower circumscription of *Scirpus* to include only about 30 leafy-stemmed species related to the conserved type of the genus, *Scirpus sylvaticus* L., of Europe. Recently, a few North American authors (e.g., Weber and Wittmann 1992; Strong 1994; Smith 1995; Browning et al. 1995) have begun to accept *Scirpus* sensu stricto and various segregates, although the number and circumscription of these segregate genera remain somewhat controversial. The underlying assumptions for the revised generic classification of the complex are that *Scirpus* sensu lato is polyphyletic (Goetghebeur 1986; Strong 1994; Bruhl 1995), and that the resultant smaller genera consist of more homogeneous species groups. Phylogenetic studies by Goetghebeur (1986) and Bruhl (1995) disagree in details, but both suggest that *Scirpus* sensu lato is polyphyletic. Bruhl's (1995) recent, comprehensive studies suggest that portions of the group (including *Bolboschoenus*, *Scirpus* sensu stricto, and *Trichophorum*) are part of a clade that includes *Dulichium* and *Fuirena*, whereas other portions (including *Isolepis* and *Schoenoplectus*) comprise part of a clade that includes *Eleocharis* and *Eriophorum*. However, Bruhl (1995) stresses that the Scirpeae are one of the most contentious groups on his cladogram, and that the tribe is perhaps the one portion of the family in greatest need of further taxonomic study. Our conclusion from these studies is that it seems most prudent to recognize as separate genera the series of apparently monophyletic units that are in use in much of the world's floristic literature, in spite of the need for further studies on phylogenetic and taxonomic relationships among these genera.

The present paper includes reports for three species and one variety new to the flora of Missouri. We also reconcile the more traditional monogeneric classification of *Scirpus* with current ideas concerning segregates by providing a key to genera and a summary of the currently recognized Missouri taxa, along with pertinent synonymy.

GENERIC SUMMARY

Preparation of a treatment of *Scirpus* sensu lato by A. E. Schuyler, S. G. Smith, W. J. Crins, and others for a forthcoming

volume of the Flora of North America (Oxford University Press, in prep.) has resulted in a revised classification for the temperate North American members of the group. This is in general agreement with the classification of Goetghebeur (1986) and Bruhl (1995), which formalized many ideas already in use in most of the recent floristic and taxonomic treatments of non-American Scirpeae. Morphological data supporting this classification were summarized by Goetghebeur (1986), Strong (1994), and Bruhl (1995). Smith (1995) published new combinations for various taxa to bring nomenclature into conformation with this scheme. Of the approximately nine genera that will be recognized in the Flora of North America treatment, five are represented in Missouri.

The following is a key to the genera segregated from *Scirpus* sensu lato based on species known from Missouri:

1. Stems with elongated internodes and thus leafy; leaf blades well developed, thin and flat; main involucre bract generally spreading, thin and flat like the leaf blades . . . (2)
2. Spikelets ca. 4–10 mm thick; spikelet scales minutely pubescent (the hairs often worn off), the midrib apex extended into a prominent awn; leaves lacking ligules; prominent corms generally present at shoot bases and on rhizomes *Bolboschoenus*
2. Spikelets ca. 1–3.5 mm thick; spikelet scales glabrous, the midrib not prominently extended; leaves with low, scarious ligules; corms lacking *Scirpus*
1. Stems without evident internodes and thus leaves all basal, or rarely with one leaf in middle of stem; leaf blades well developed to rudimentary, thick and spongy to thin and flat; main involucre bract erect or sometimes bent to the side, thick and often superficially resembling the stem (3)
3. Spikelets 1–3 per stem, ca. 2–8 mm long, sessile at stem apex; involucre bract 1(2); achenes 0.7–2 mm long; plants densely cespitose (4)
4. Spikelet 1; achenes with 3–6 bristles; leaf blades 0.8–2 mm wide *Trichophorum*
4. Spikelets 1–3; achenes lacking bristles; leaf blades to 0.5 mm wide *Isolepis*

3. Spikelets 1–100+ per stem, ca. 2–24 mm long, sessile at stem apex or many on branches; involucre bracts 1 to several; achenes ca. 1.2–4.5 mm long; plants spreading by long rhizomes or densely cespitose
 *Schoenoplectus*

LIST OF TAXA

The list below includes taxa of *Scirpus* and its segregates accepted for Missouri. Synonymy given here includes basionyms, as well as names that were used by Steyermark (1963) and other recent floras for the region.

Scirpus sensu stricto

1. *Scirpus atrovirens* Willd.
Scirpus atrovirens f. *sychnocephalus* (Cowles) S.F. Blake
2. *Scirpus cyperinus* (L.) Kunth
Eriophorum cyperinum L.
Scirpus cyperinus var. *pelius* Fernald
Scirpus rubricosus Fernald
3. *Scirpus divaricatus* Elliott
4. *Scirpus georgianus* R.M. Harper
Scirpus atrovirens Willd. var. *georgianus* (R.M. Harper)
 Fernald
5. *Scirpus pallidus* (Britton) Fernald
Scirpus atrovirens Willd. var. *pallidus* Britton
6. *Scirpus pedicellatus* Fernald
7. *Scirpus pendulus* Muhl. ex Elliott
Scirpus lineatus auct., non Michx.
8. *Scirpus polyphyllus* Vahl

Schoenoplectus

9. *Schoenoplectus acutus* (Muhl. ex Bigelow) Á. Löve & D. Löve var. *acutus*
Scirpus acutus Muhl. ex Bigelow
10. *Schoenoplectus americanus* (Pers.) Volkart ex Schinz & R. Keller
Scirpus americanus Pers.
Scirpus olneyi A. Gray
11. *Schoenoplectus deltarum* (Schuyler) Soják
Scirpus deltarum Schuyler

12. *Schoenoplectus etuberculatus* (Steud.) Soják
Rhynchospora etuberculata Steud.
Scirpus etuberculatus (Steud.) Kuntze
13. *Schoenoplectus hallii* (A. Gray) S.G. Smith
Scirpus hallii A. Gray
Scirpus supinus L. var. *hallii* (A. Gray) A. Gray
14. *Schoenoplectus heterochaetus* (Chase) Soják
Scirpus heterochaetus Chase
15. *Schoenoplectus mucronatus* (L.) Palla
Scirpus mucronatus L.
- 16a. *Schoenoplectus pungens* (Vahl) Palla var. *pungens*
Scirpus pungens Vahl
Scirpus americanus auct., non Pers.
- 16b. *Schoenoplectus pungens* var. *longispicatus* (Britton) S.G. Smith
Scirpus americanus Pers. var. *longispicatus* Britton
Scirpus americanus var. *polyphyllus* (Boeck.) Beetle in part (epithet of uncertain application; see Koyama 1962)
17. *Schoenoplectus purshianus* (Fernald) M. Strong
Scirpus purshianus Fernald
18. *Schoenoplectus saximontanus* (Fernald) J. Raynal
Scirpus saximontanus Fernald
Scirpus supinus L. var. *saximontanus* (Fernald) T. Koyama
19. *Schoenoplectus subterminalis* (Torr.) Soják
Scirpus subterminalis Torr.
20. *Schoenoplectus tabernaemontani* (C.C. Gmel.) Palla
Scirpus tabernaemontani C.C. Gmel.
Scirpus validus Vahl
Schoenoplectus validus (Vahl) Á. Löve & D. Löve
Scirpus validus var. *creber* Fernald
21. *Schoenoplectus torreyi* (Olney) Palla
Scirpus torreyi Olney

Bolboschoenus

22. *Bolboschoenus fluviatilis* (Torr.) Soják
Scirpus maritimus L. β *fluviatilis* Torr.
Scirpus fluviatilis (Torr.) A. Gray
Schoenoplectus fluviatilis (Torr.) M. Strong
23. *Bolboschoenus maritimus* (L.) Palla ssp. *paludosus* (A. Nelson) T. Koyama

- Scirpus paludosus* A. Nelson
Scirpus maritimus L. var. *paludosus* (A. Nelson) Kük.
Bolboschoenus paludosus (A. Nelson) R. Soó
Bolboschoenus maritimus (L.) Palla ssp. *paludosus* (A. Nelson) Á. Löve & D. Löve

Isolepis

24. *Isolepis carinata* Hook. & Arn. ex Torr.
Scirpus carinatus (Hook. & Arn. ex Torr.) A. Gray (1868),
 non *Scirpus carinatus* Smith (1809)
Scirpus koilolepis (Steud.) Gleason
Isolepis koilolepis Steud.
25. *Isolepis molesta* (M.C. Johnst.) S.G. Smith
Scirpus molestus M.C. Johnst.

Trichophorum

26. *Trichophorum planifolium* (Muhl.) Palla
Scirpus planifolius Muhl. (1817), non *Scirpus planifolius*
 Grimm (1767)
Scirpus verecundus Fernald

NEW RECORDS FOR MISSOURI

The following three species were added to Missouri's flora during the time between the publication of Steyermark's (1963) flora and Yatskievych and Turner's (1990) checklist: *Scirpus pedicellatus*, *Schoenoplectus deltarum*, and *Schoenoplectus saximontanus*. County occurrences and voucher specimens for these additions were given (as *Scirpus*) by Turner and Yatskievych (1992) and are updated briefly here.

***Scirpus pedicellatus*.** Although Steyermark (1963) excluded this segregate of *Scirpus cyperinus* from Missouri, Schuyler (1963) noted it from Adair and Macon Counties. Turner and Yatskievych (1992) cited an additional record from Putnam County. Subsequent herbarium searches have not expanded the range beyond these counties.

***Schoenoplectus deltarum*.** This species in the "*Schoenoplectus pungens* complex" (including *Schoenoplectus americanus* and *Schoenoplectus pungens*) was described by Schuyler (1970, as

Scirpus deltarum), who included Missouri records from Holt and Howard Counties. It is very similar to *Schoenoplectus pungens* but has some characteristics of *Schoenoplectus americanus*. Although the Howard County specimen is typical of *Schoenoplectus deltarum* in achene and bristle morphology, the Holt County specimen lacks mature achenes and seems somewhat atypical for *Schoenoplectus deltarum*. Instead, it may represent an aberrant specimen of *Schoenoplectus pungens* or a hybrid between *Schoenoplectus pungens* and *Schoenoplectus americanus* (S. G. Smith, unpubl.). Several other collections from southern Missouri have the increased spikelet number typical of *Schoenoplectus deltarum*, but are otherwise typical of *Schoenoplectus pungens*.

***Schoenoplectus saximontanus*.** Castaner (1984) first reported this species (as *Scirpus saximontanus*) for Missouri from Platte County in the northwestern part of the state. The following specimen has been collected since then in eastern Missouri, near St. Louis: St. Charles County, U.S. Army Corps of Engineers Riverlands National Environmental Demonstration Area, just S of Alton, Illinois near SW bank of Mississippi River, in wet, sandy depression, 38°52'15"N, 90°12'30"W, 16 Oct 1992, R. H. Mohlenbrock s.n. (MO). The site is a bottomland prairie/marsh complex that has been impacted heavily by previous farming in the area, as well as construction of nearby levees. Both of the Missouri stations are natural wetlands and it is difficult to speculate whether this species is a recent introduction into Missouri. However, as with *Schoenoplectus mucronatus* and *Schoenoplectus purshianus*, the most likely explanation for the establishment of these populations is that achenes were transported in the guts or in mud on the feathers or feet of migratory waterfowl (see also *Schoenoplectus purshianus* below).

Recent herbarium research has documented the existence of two presumed interspecific hybrids in Missouri. Field and herbarium studies also resulted in the discovery of three additional species for the state that are reported here for the first time.

***Schoenoplectus acutus* × *tabernaemontani*.** The following specimens represent putative hybrids between *Schoenoplectus acutus* and the closely related *Schoenoplectus tabernaemontani*: Lafayette County, South Fork Fen, 3.5 mi SSE of Waverly, 12

June 1996, *S. G. Smith* 8822 (MO); Saline County, lakes, Arrow Rock, 1 Sep 1929, *J. H. Kellogg* 15128 (MO); St. Charles County, Marais Temps Clair Wildlife Area, 10 July 1985, *A. Christ s.n.* (MO). These specimens consist of soft-stemmed plants with floral scale color and morphology intermediate between the two putative parents. The Lafayette County specimen lacks achenes, but the Saline and St. Charles County collections appear to have fully-formed achenes. Interspecific hybridization in this complex was studied by Smith (1969), Dabbs (1971), and Shay et al. (1988), who noted that hybrids appear most frequently in disturbed habitats and that the parental taxa are separable taxonomically throughout much of their North American ranges. Several other specimens we have seen that we have identified as *Schoenoplectus acutus* are probably “introgressants” from *Schoenoplectus tabernaemontani*. Further instances of hybridization between *Schoenoplectus acutus* and *Schoenoplectus tabernaemontani* may be expected in northern Missouri, as most of the wetlands in this part of the state have been impacted heavily and repeatedly by agriculture and other physical and hydrological perturbations.

Schoenoplectus acutus × *heterochaetus* [*Schoenoplectus* × *oblongus* (Koyama) Soják]. The following specimen is intermediate morphologically between *Schoenoplectus acutus* and *Schoenoplectus heterochaetus* and is presumed to be a hybrid: St. Louis County, Pinks Lake, Allenton, 10 May 1897, *J. H. Kellogg s.n.* (MO). In addition, the illustration labeled *Scirpus acutus* in Steyermark's (1963) Flora of Missouri (Plate 77, Figure 2) shows a keeled achene and open inflorescence typical of this hybrid, and may well be drawn at least in part from a hybrid plant. This hybrid is relatively common throughout the North American range of *Schoenoplectus heterochaetus* (S. G. Smith, unpubl.).

Schoenoplectus mucronatus. This species is a native of Eurasia that has become naturalized in California in rice fields and waste places since at least 1947 (Bellue 1947; Mason 1957; Smith et al. 1993; S. G. Smith, unpubl.). It is known from a few localities in the eastern United States and adjacent Canada, where it apparently does not persist. It has been reported recently from Illinois (Schwegman 1984), Tennessee (Churchill 1992), and southwestern Iowa (Wilson 1992). The following eastern Missouri specimen was determined previously as *Schoenoplectus*

pungens: Lincoln County, Cuivre River State Park, edge of Lake Lincoln, in cove where old road goes down to man-made lake, T49N R1E S9, 28 June 1987, B. Schuette 1502 (MO).

Schoenoplectus mucronatus is similar superficially in its trigonous culms to the more robust, widespread *Schoenoplectus pungens*, but differs in its densely tufted growth form, with the short rhizomes obscured by the culm bases (vs. spreading by elongate rhizomes in *Schoenoplectus pungens*); inflorescence bract generally bent to one side (vs. strictly erect); lack of leaf blades; spikelet scales mucronate and entire (vs. apex prominently awned and notched); and achenes rugose (smooth in *Schoenoplectus pungens*).

As with the Missouri records of *Schoenoplectus purshianus* (see below), the recent new records of *Schoenoplectus mucronatus* in Iowa, Illinois, and Missouri were collected in man-made wetlands, mostly of relatively recent origin. The most likely explanation for these new populations is that achenes are transported in the guts or in mud on the feathers or feet of migratory waterfowl, which depend upon such artificial wetlands in a landscape where most of the natural aquatic habitats have been destroyed or altered during the past few centuries since colonization by Europeans. It seems likely that these species will continue to expand their ranges in the future.

Schoenoplectus purshianus, new to Missouri. This native of the eastern United States is reported here for the first time from Missouri based on the following collection: Washington County, YMCA of the Ozarks, 2.5 mi N of Shirley, W shore of Sunnen Lake (an artificial lake), T37N R1E S9, 27 Sep 1990, G. Yatskievych 90-423 (MO). As suggested above, this population is undoubtedly of recent origin.

Several authors (e.g., Voss 1972) included *Schoenoplectus purshianus* within the closely related *Schoenoplectus smithii*, which is somewhat more northern in distribution and not known from Missouri. It differs from *Schoenoplectus smithii* in several characters, including its mostly thicker and rounded-obovate (vs. mostly cuneate-obovate) achenes; its stouter bristles, which are usually present in *Schoenoplectus purshianus*, but often absent in *Schoenoplectus smithii*; and its generally shorter and often divergent inflorescence bract (always erect in *Schoenoplectus smithii*).

Schoenoplectus purshianus, *Schoenoplectus hallii*, and *Schoen-*

oplectus saximontanus are very similar in their small, densely tufted habit with culms very variable in length in the same tuft. They belong to two different taxonomically difficult complexes of the Old and New Worlds. In the North American flora, *Schoenoplectus mucronatus*, *Schoenoplectus purshianus*, and *Schoenoplectus smithii* belong to section *Actaeogeton* (Rchb.) J. Raynal, whereas *Schoenoplectus saximontanus*, *Schoenoplectus hallii*, and *Schoenoplectus erectus* (Poir.) Palla ex J. Raynal (incl. *Scirpus erismana* Schuyler and *Scirpus wilkensis* Schuyler) belong to section *Supini* (Cherm.) J. Raynal (Raynal 1976). Members of sections *Actaeogeton* and *Supini* somewhat resemble the *Schoenoplectus pungens* complex, but are usually less robust and are densely tufted and annual (or apparently so), with rhizomes hidden among the shoot bases. The following key distinguishes all Missouri members of sections *Actaeogeton* and *Supini*:

1. Leaves all basal; achene surface rugose to nearly smooth; leaf sheaths lacking flowers or achenes
..... *Schoenoplectus* section *Actaeogeton* (2)
2. Culms cylindric, ca. 1-2 mm thick
..... *Schoenoplectus purshianus*
2. Culms strongly trigonous, ca. 2-5 mm thick
..... *Schoenoplectus mucronatus*
1. Leaves basal and 1 on culm; achene surface generally prominently transversely ridged; basal leaf sheaths often enclosing flowers or achenes
..... *Schoenoplectus* section *Supini* (3)
3. Achenes in spikelets strongly and nearly equilaterally trigonous; styles in spikelets trifid
..... *Schoenoplectus saximontanus*
3. Achenes in spikelets lenticular or obscurely compressed-trigonous; styles in spikelets bifid
..... *Schoenoplectus hallii*

***Isolepis molesta*.** This diminutive species was first described (as *Scirpus molestus*) by Johnston (1964) from Arkansas, Louisiana, and Texas. We here report it for Missouri for the first time based on the following three collections from southwestern and southeastern Missouri, all more than 50 years old: Dade County, sandstone bluffs and glades along Sinking Creek, a tributary of Turnback Creek, 2.5 mi SW of Everton, T30N R26W S23/24, 7

May 1939, *J. A. Steyermark* 22292 (F); Dunklin County, in open soil, low flat ground surrounded by *Quercus phellos* woods about 5 mi NW of Campbell, 5 Apr 1931, *J. A. Steyermark* 386 (MO); Jasper County, low sandy woods, Smithfield, 28 May 1931, *J. H. Kellogg s.n.* (MO).

The Missouri collections originally were determined as the very similar, but more common and widespread, *Isolepis carinata* [as *Scirpus koilolepis* (Steud.) Gleason]. The two differ mainly in that *I. molesta* has achenes 0.7–0.9 mm long with the pinkish-brown surface covered with a thick, whitish, waxy coating and spikelet scales 1.0–1.3 mm long, whereas *I. carinata* has achenes 1.0–1.5 mm long with the orangish-brown surface usually lacking a waxy coating and spikelet scales 1.8–2.0 mm long. Although the two species sometimes grow together, intermediates have not been noted (Johnston 1964; S. G. Smith, unpubl.).

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